Final Education Activity Report

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Accelerated Testing of Polymeric Composites: Correlation of Scale-up Effects on Viscoelastic Behavior

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Undergraduate Student Research

Winona State University is an undergraduate institution, and the composite materials engineering program is an ABET accredited undergraduate program offering B.S. degree in Composite Materials Engineering (CME). Over the last three years, eight students in the CME program have worked in this research project. These students gained hands-on research experience in planning a research project, brainstorming, literature review, experimentation, data analysis, discussion of results, documentation of important findings, writing reports and publishing papers. One of the students, Mr. David Machac, spent a summer as a LARSS scholar working with the Research Associate Dr. Tom Gates at Langley Research Center. Two students fulfilled their senior seminar course by working on the project and giving presentation on their findings. Another student gave a presentation at the Winona Area Composite Consortium. One of the students published a paper in the WSU College of Science and Engineering Journal.

Published papers that include student contribution are:

Abdel-Magid, B., Gates, T., and **Pawlitzke, B.** (2003), "Prediction of Long-term Creep Properties of Polymer Matrix Composites," Proceedings of the 18th Annual Technical Conference of the American Society of Composites, October 2003.

Brad Pawlitzke and Beckry Abdel-Magid, (2003), "Accelerated Testing to Obtain Viscoelastic Creep Properties of Polymer Matrix Composites", WSU College of Science and Engineering Journal, Winona State University, Volume 01, No. 01, Fall 2003

Abdel-Magid, B., Gates, T., and **Zanmiller, J.**, "Testing Method and Scale-up Effects on the Viscoelastic Creep Properties of Polymeric Composites", in preparation to be submitted to the Journal of Composite Materials.

Papers that were published with student contributions from projects that are related to this project include:

Beckry Abdel-Magid, **Glen Smith**, **Katrina Gass**, and Roberto Lopez-Anido, (2004), "Flexure Creep in Three and Four Point Bending Tests of Unidirectional Glass/Urethane Composites", Proceedings of SAMPE 2004 Conference, Long Beach California, May 2004.

Glen Smith, **Katrina Gass**, and Beckry Abdel-Magid, (2004), "The Effect of Specimen Loading on the Long-term Properties of Composite Materials", WSU College of Science and Engineering Journal, Fall 2004, Vol. 1, No. 2.

Abdel-Magid, B., Lopez-Anido, R., **Smith, G.**, and **Trofka, S.**, (2003), "Flexure Creep Properties of E-glass Reinforced Polymers," Journal of Composite Structures, Vol. 62/3-4, pp 246-253.

Abdel-Magid, Lopez-Anido, **Smith, M.**, **Machac, D.**, and **Bausman III, D.**, (2003), "Creep and Creep Rupture Properties of Glass Polymer Composites," Proceedings of the Fourth International Conference on Composite Science and Technology, January 2003.

Meigen Smith, and Beckry Abdel-Magid, (2003), "The Importance of Creep and Creep Rupture Testing in Material Selection", WSU College of Science and Engineering Journal, Winona State University, Volume 01, No. 01, Fall 2003

Curriculum

The knowledge obtained and the experimental and analytical procedures developed in this research project are being incorporated in two courses: Mechanics of Composite Materials, and Mechanical Characterization of Composites.

Conclusions

The research project had a very positive educational impact on students and faculty in the CME Program at Winona State University. The educational activity included undergraduate student research, classroom discussion, and laboratory work. Students engaging in research benefited from the hands-on experience and the sense of discovery while students in the classroom learned about current developments in their field. In addition to dissemination of results in technical papers and professional conferences, the research and educational activities were also publicized in local and regional magazines and newspapers.